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Anode carbon enrichment in GMAW

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Abstract: The shielding gas used in the welding process has a strong influence on the metal transfer characteristics. When the gas is chemically active the physicochemical properties of the electrodes can be strongly altered which can increase or decrease arc stability. In order to get a better control over the process it is essential to understand how the electrodes are affected. As the electrode extremities are molten they can easily adsorb gases from the shielding gas, which can affect their microstructure. CO_2 is one of the most commonly used active shielding gases. It is then interesting to know if the liquid metal at the extremity of the electrode can adsorbed the carbon it supplies, as it has strong influence on steel mechanical properties. Besides, various phases can form during metal cooling, depending on its concentration. It is then possible to get information on the carbon content by studying the ratio between phases. In order to show a possible enrichment, only the relative spatial evolution can be studied and no accurate phase identification is needed. Cross sections of the samples have been studied, using mainly optic microscopy. The two main phase ratio have been calculated after processing the obtained images. The results show a higher ratio of the phase associated to the highest carbon content close to the sample periphery, which support the hypothesis of carbon adsorption by the molten metal.

Keywords : welding, microstructure, CO2, carbon, anode, Ferrite